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Enhancing the ELV Payload Safety Review Process Through Programmatic Activities

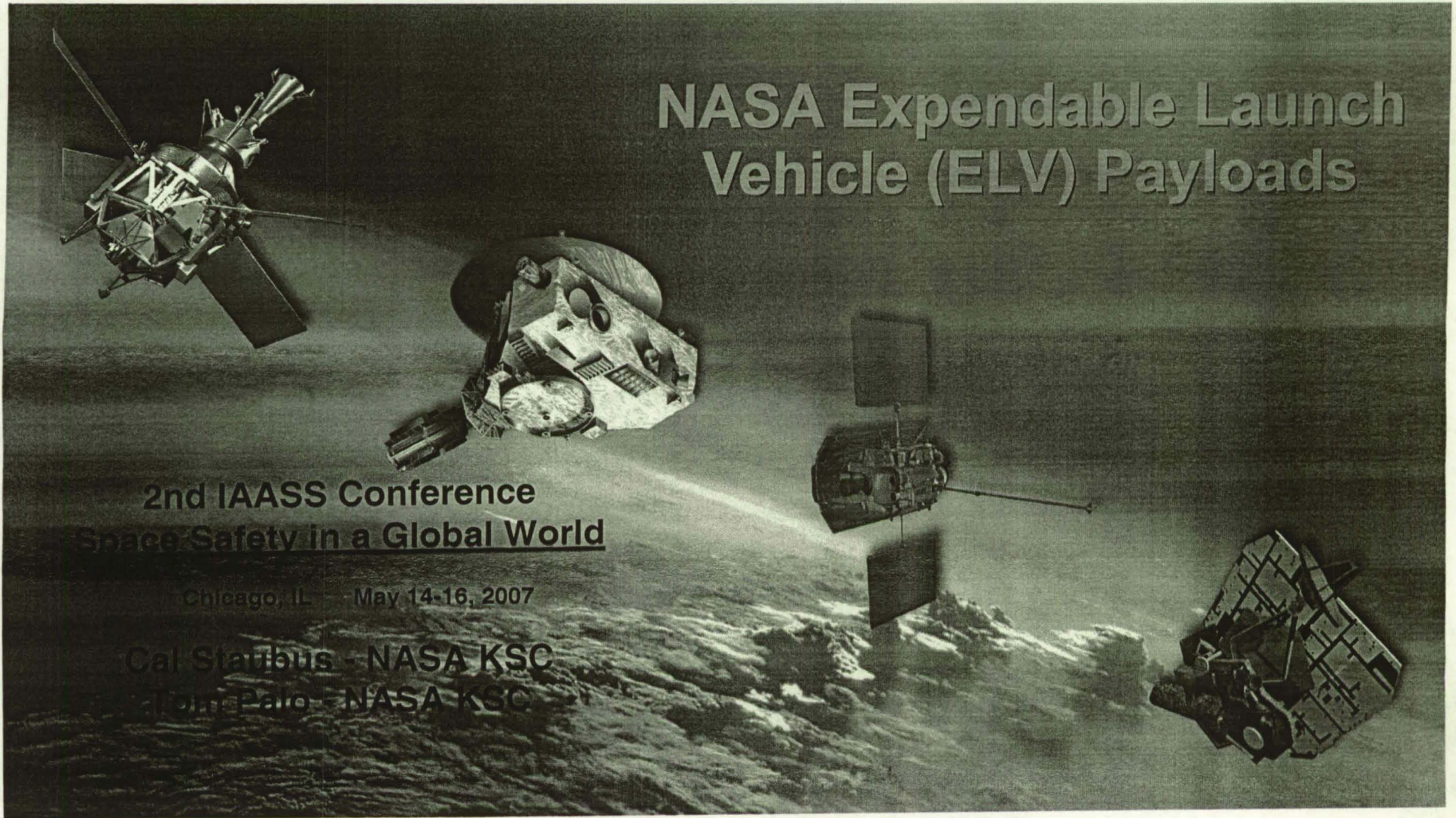
NASA Expendable Launch Vehicle (ELV) Payloads

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Chicago, IL May 14-16, 2007

Cal Staibus - NASA KSC

Tom Palo - NASA KSC





NASA Expendable Launch Vehicle Payload Safety Program

Enhancing the ELV Payload Safety Review Process Through Programmatic Activities

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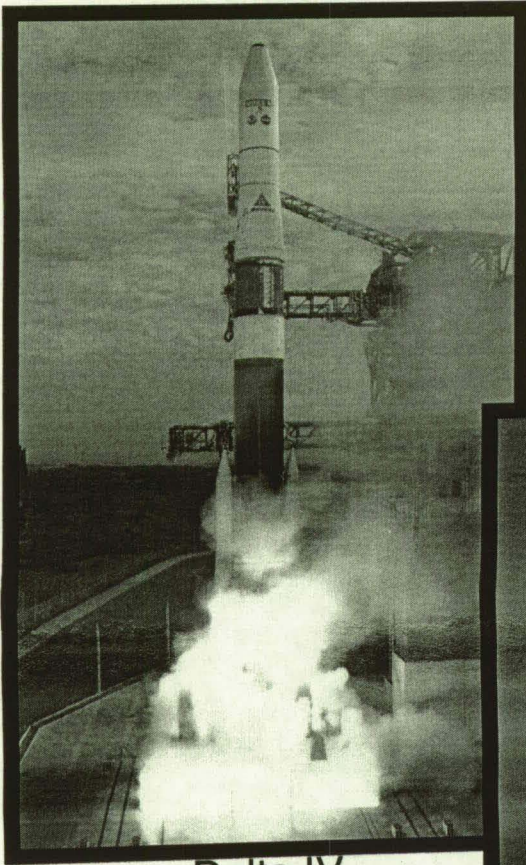
ELV Payload Safety Program Topics

- **ELV Payload Safety Description**
- **ELV Payload Safety Program Background**
 - **Brief History**
 - **NASA-STD-8719.8 Background**
- **Program Elements and Issues**
- **Program Enhancements**
- **Program Implementation**
- **Program Evaluation and Review for Improvements**



ELV Payload Safety Program Description

- **Payloads (spacecraft) that fly to orbit on an Expendable Launch Vehicles (ELV)**
 - Delta II
 - Pegasus
 - Delta IV
 - Atlas V
 - Others
- **Applies to Orbital and Deep Space ELV Missions (unmanned)**
 - Earth Science Missions
 - Planetary (Robotic) Missions
 - Helio physics (Sun) Missions
- **Safety of resources (people, facilities and equipment)**



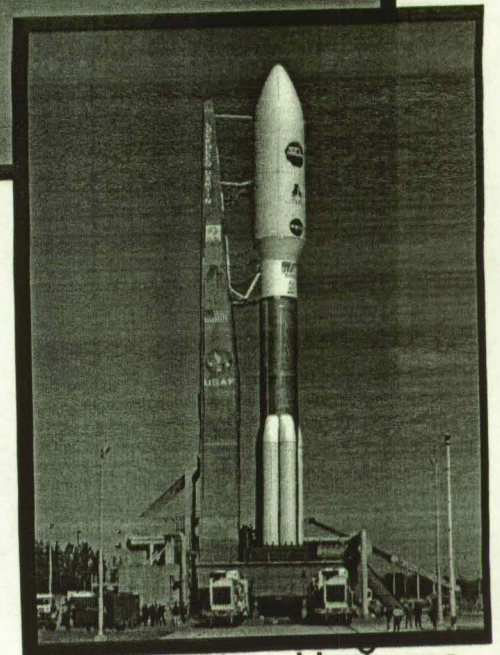
Delta IV
GOES N



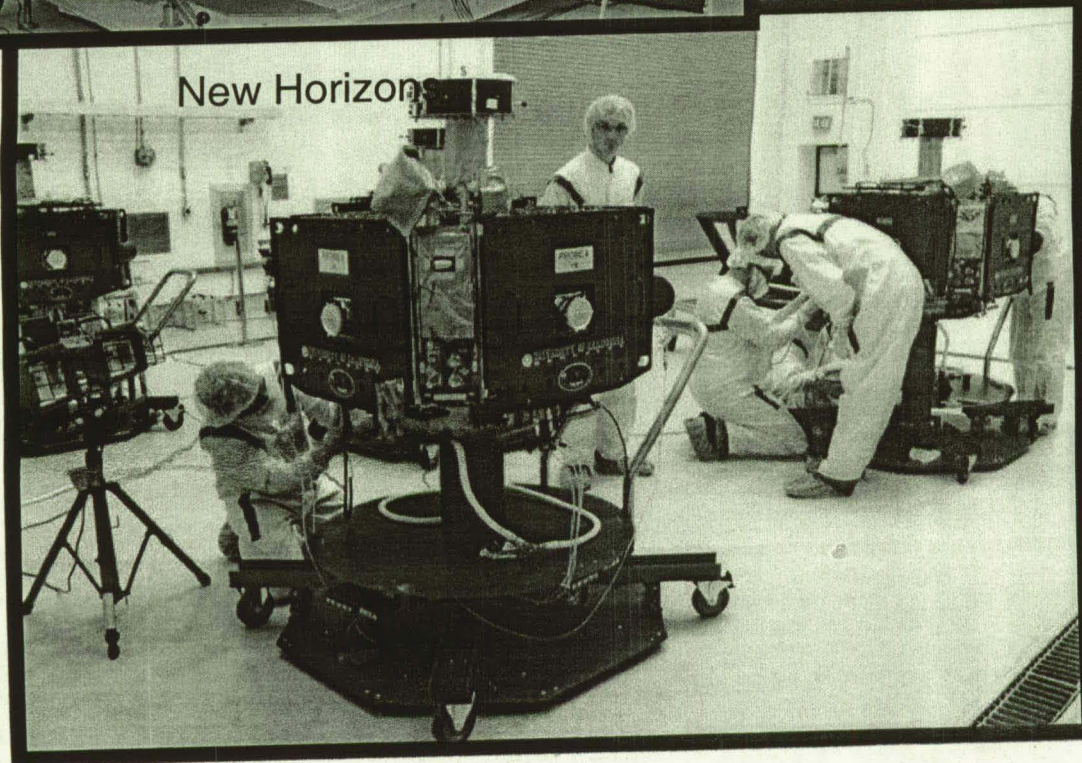
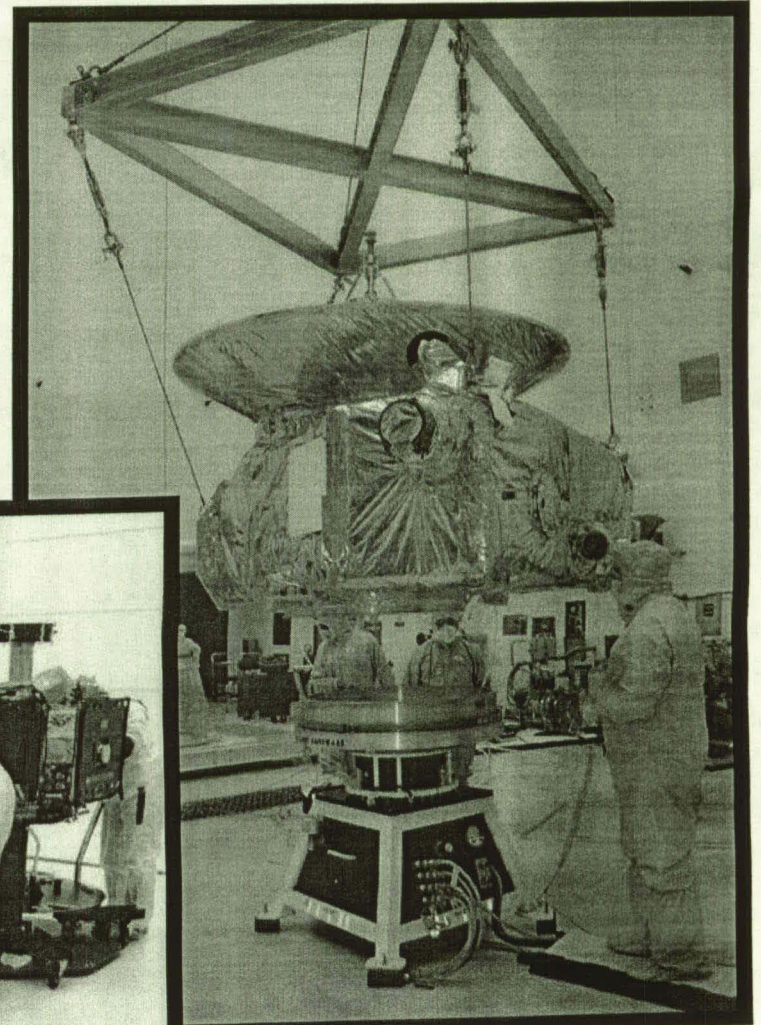
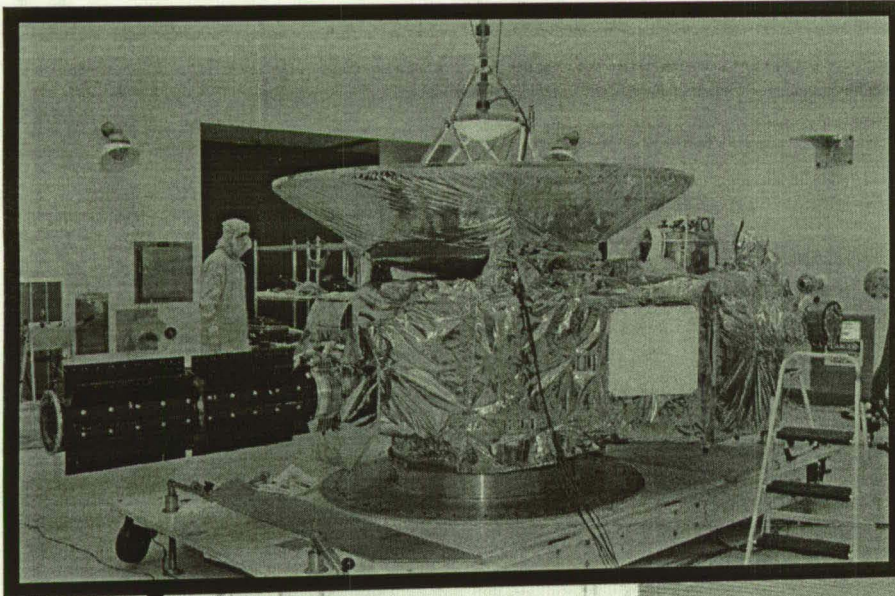
PEGASUS

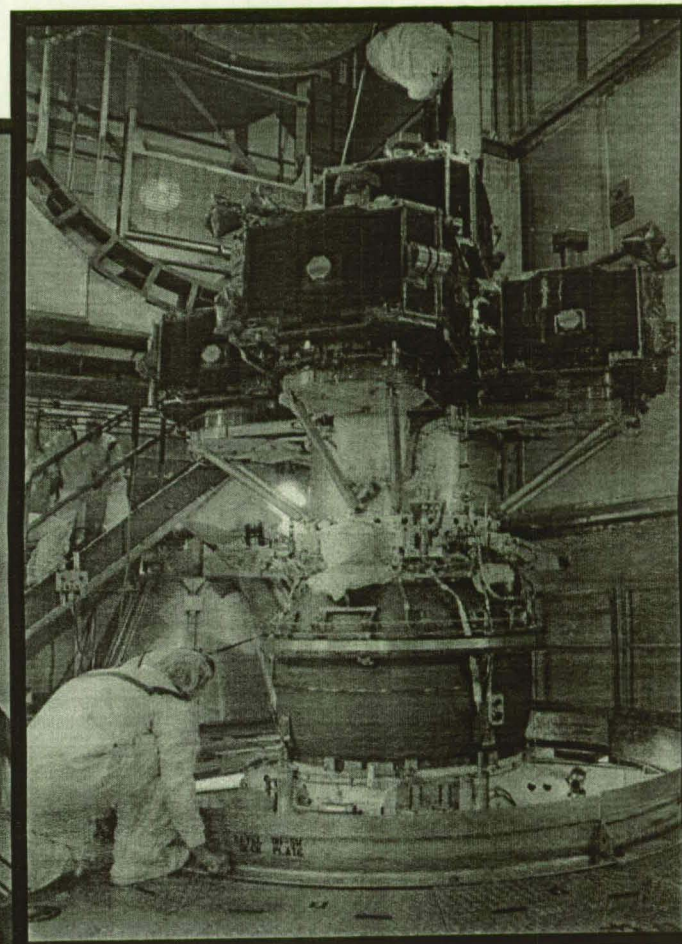
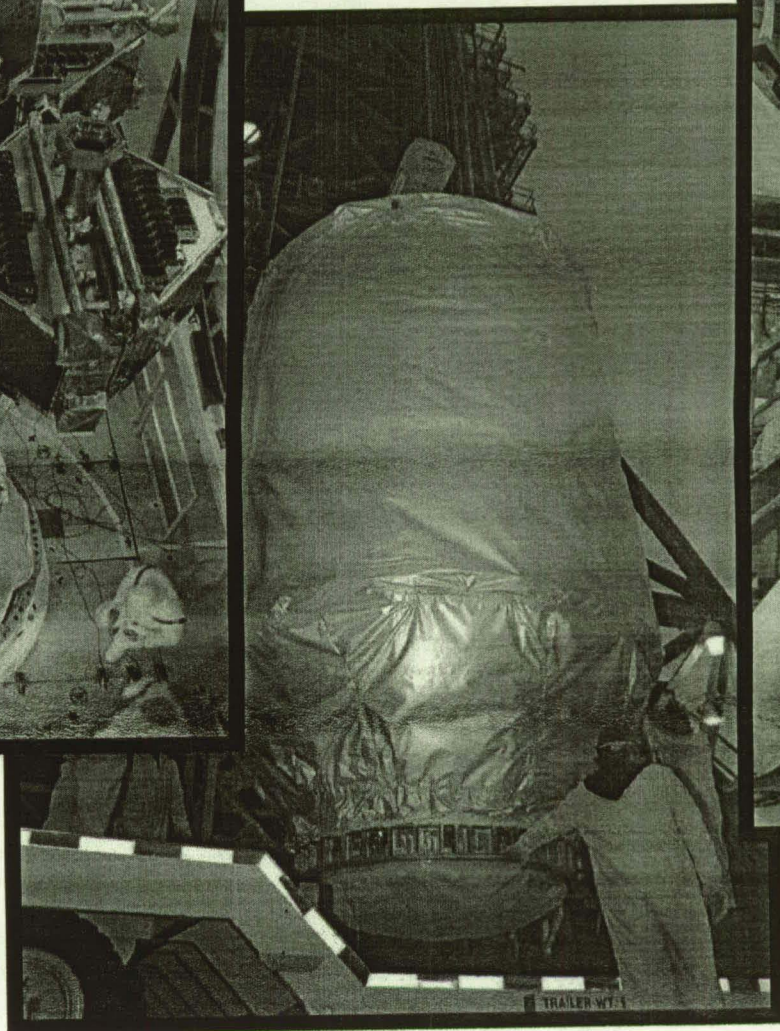
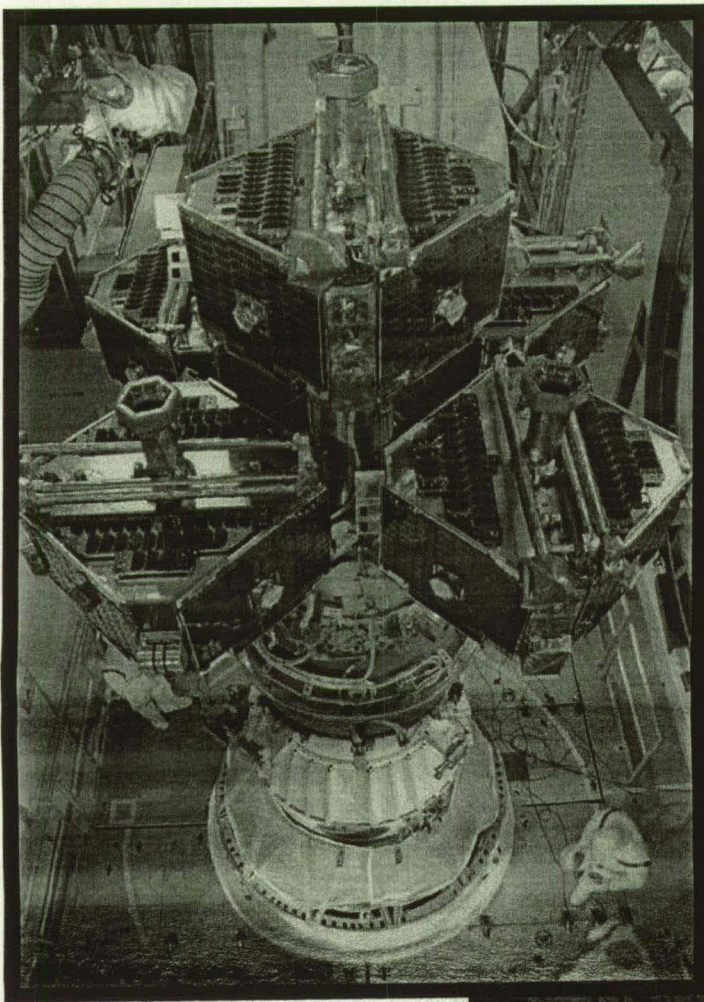


Delta II THEMIS
Protecting:



Atlas V New Horizons







ELV Payload Safety Program Background (Brief History)

- **NASA ELV Payload Projects have always had to comply with NASA safety and Air Force Range Safety requirements**
- **Payload projects must comply with Air Force Range requirements to launch from an Air Force controlled Range**
 - **This is still true today**
- **1990's emphasized more efficiency**
 - **NASA's "insight" of contractor operations**
 - **NASA's Faster-Better-Cheaper mentality**
 - **Full Cost Accounting and Fixed Price Launches**
 - **NASA payload safety held fast**
- **Mid-1990's a need for a NASA review process was realized**
- **June 1998 NASA-STD-8719.8 *ELV Payload Safety Review Process Standard* became effective**



ELV Payload Safety Program NASA-STD-8719.8 Background

- **“ELV Payload Safety Review Process Standard”**
 - Focused on approval to process at launch site
 - Designed for missions involving numerous organizations and various vehicle/launch site combinations
 - Has been successful (with ad hoc changes) for NASA ELV payloads
 - Certain complications evolved since the process standard was developed:
 - Complicated roles for projects involving multiple NASA Centers
 - Projects involving international partners proved difficult
 - Lack of approval process for use/re-flight of common spacecraft bus
 - Lack of process for resolving dissenting opinions within NASA and with external organizations
 - Lack of acceptance of external approving authority and requirements



ELV Payload Safety Program Elements and Issues

- **Requires a Payload Safety Working Group (PSWG) for each payload**
 - **Members represent all safety organization involved in mission**
 - **Payload, Launch Vehicle, Processing Facility, Range Safety, etc.**
- **PSWG support by a Center/organization may change for the same mission, and from one mission to the next (even when a common, previously approved spacecraft bus is assessed)**
 - **Lack of communication between members within some organizations**
 - **Technical concerns sometimes handled differently for similar payloads**
- **Relies heavily on other agencies' requirements (e.g., Air Force)**
 - **Subject to other agencies' interpretation of requirements**
 - **Other agencies' safety focus perceived to vary when it is not their payload**
 - **NASA's authority is sometimes misunderstood and decisions challenged when using other agencies' requirements documents**



ELV Payload Safety Program Elements and Issues

- Requires ‘Tailoring’ of requirements for each payload**
 - Subject to misunderstanding the process and benefits, and poor implementation**
 - Current process lacks the strict and consistent oversight on all projects needed for proper implementation**
- Relies on the ability of the PSWG to reach consensus**
 - Current process does not identify a decision-making authority**
 - No clear direction for when consensus cannot be reached**
 - Resolution of contentious issues can drag-on until the ‘final hour’**
 - No clear direction on the applicable Safety Variance Process**



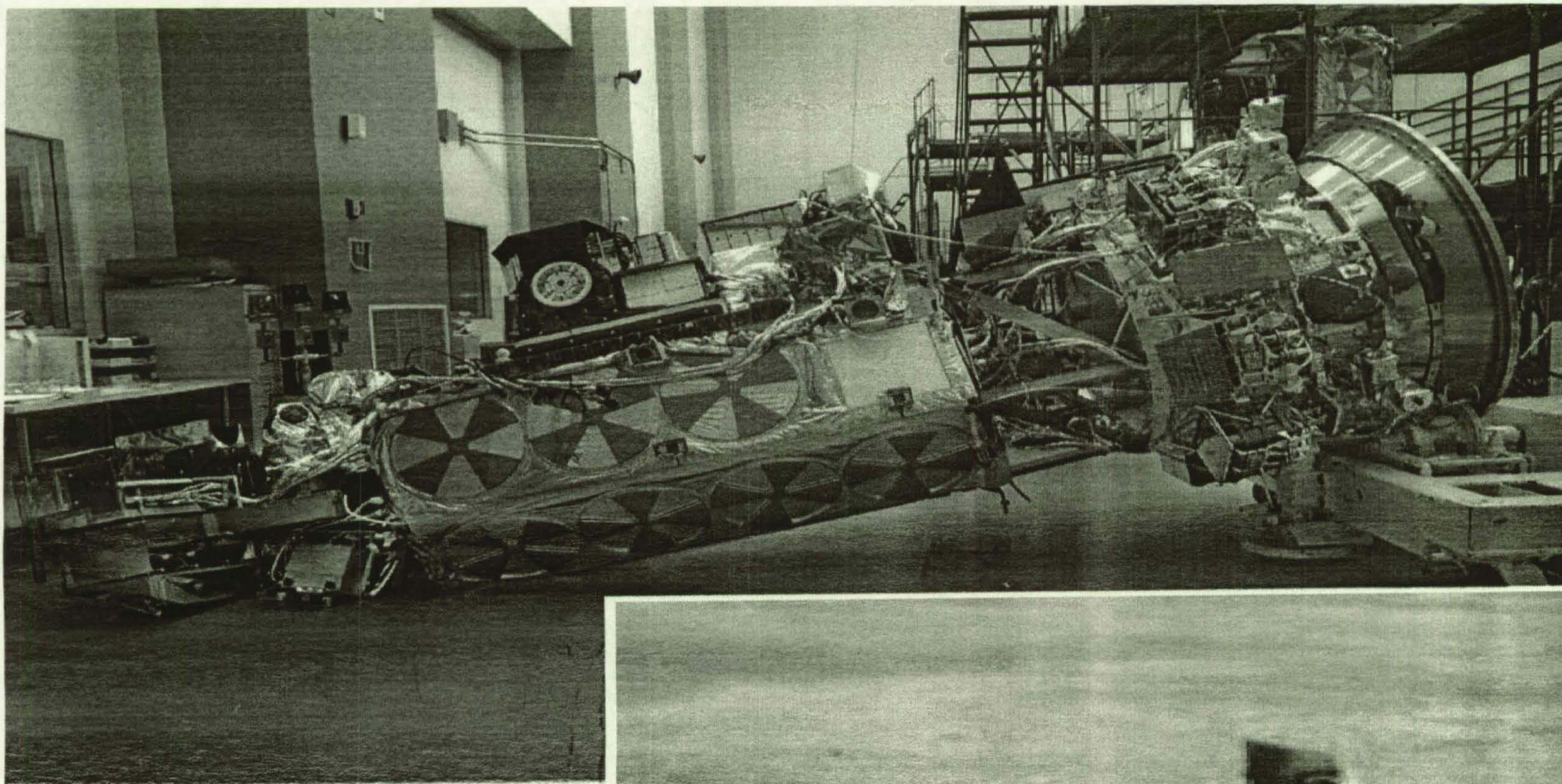
ELV Payload Safety Program Process Elements and Issues

- **Process has a limited scope**
 - **Focus is on approval for pre-launch processing at launch site and launch approval.**
 - **Scope doesn't fully address lifecycle concerns: contract requirements, design, manufacturing, integration and test, planned recovery**
- **Enhance Agency 'perspectives'**
 - **Consistency between ELV payload projects in implementation of requirements**
 - **Proactive communication of common issues and concerns**
 - **Consistency in risk assessment**



ELV Payload Safety Program Programmatic Issue Summary

- **Issues to be addressed by an Agency ELV Payload Safety Program:**
 - **Complicated roles and responsibilities associated with multi-partner projects**
 - **Working relationships and communications between all organizations involved in the payload safety process**
 - **Consistent interpretation and implementation of safety requirements from one project to the next**
 - **Consistent implementation of the Tailoring Process**
 - **Clearly defined NASA decision-making-authority**
 - **Bring Agency-wide perspective to each ELV payload project**





ELV Payload Safety Program

Programmatic and Administrative Enhancements

- **A small Agency Team was formed to develop and implement the Program**
- **Agency Team**

GSFC	Bo Lewis, James Harper
KSC	Cal Staubus, Tom Palo
JPL	Jim Lumsden, Ben Lucas
HQ	Mike Dook
- **Draft Program Policy and Process/Requirements (NPR 8715.XX)**
- **Coordinate with external organizations**
- **Ensure Program is consistent with current Agency directives and the implementation of Independent Technical Authorities**



ELV Payload Safety Program

Programmatic and Administrative Enhancements

Agency Team Activities

- **Developed a Charter for guidance listing objectives and Program Concepts Details the program development effort**
 - **Intended to help resolve philosophical differences as a first step**
- **Kick-off meeting at NASA HQ, March 10, 2005 - Received input/direction from OSMA Management**
- **Fact Finding/Program Development Meetings @ KSC, Patrick AFB, Vandenberg AFB, JPL, and WFF**
- **Draft Policy with high level objectives, roles and responsibilities placed in NPR 8715.3 *General Safety Program***
- **Draft ELV Payload Safety Review Process and Payload Safety Requirements (still in work)**



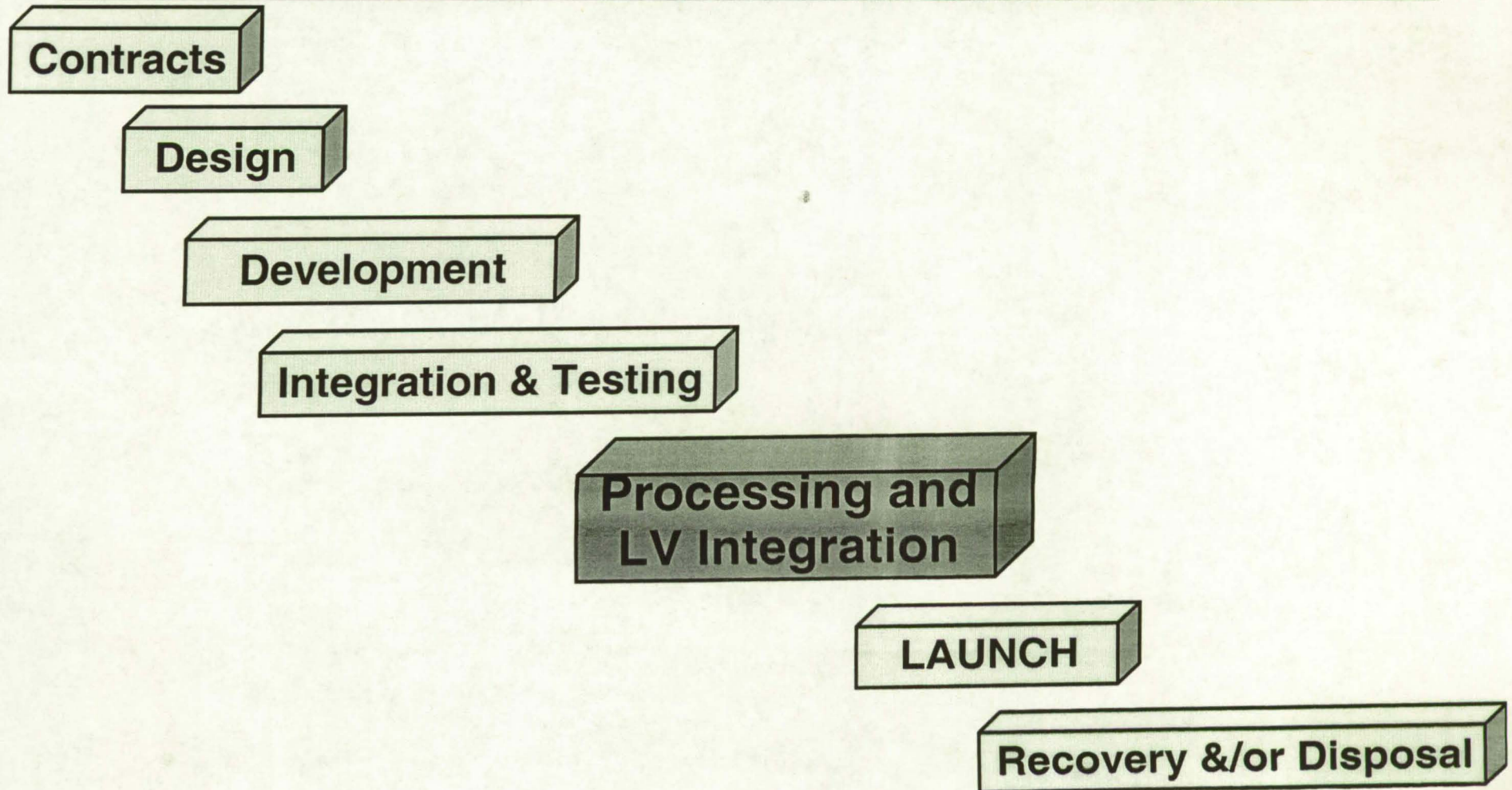
ELV Payload Safety Program

Programmatic and Administrative Enhancements

- **Program Scope Expansion from just launch area payload processing to spacecraft (payload) lifecycle**
- **Goal: The ELV Payload Safety Program will provide improved structure and processes for ensuring NASA ELV Payloads are designed, transported, processed, tested, integrated with the launch vehicle, launched and when applicable returned safely in support of mission success**
- **Proper contract safety language allows for a safe design and safe operations that allows for safe testing and payload processing**



ELV Payload Life Cycle





ELV Payload Safety Program

Programmatic and Administrative Enhancements

- **Replace the current NASA-STD 8719.8 with:**
 - More clear policy and requirements (NPR): Review Process and “Performance-Level” Payload Safety “Requirements” with tailored Air Force Range Safety (AFSPCMAN 91-710) requirements being added
- **Guidance for NPR Development:**
 - NASA-STD-8719.8 *ELV Payload Safety Review Process*
 - KHB 1700.7 *Space Shuttle Payload Ground Safety Handbook*
 - D-560 JPL *Standard for System Safety*
 - NSTS/ISS 13830 *Payload Safety Review and Data Submittal Requirements*
 - AFSPCMAN 91-710 *Range Safety User Requirements*
 - NPR 8715.3 *General Safety Program Requirements*
 - Industry Standards



ELV Payload Safety Program

Programmatic and Administrative Enhancements

- **NPR 8715.XX ELV Payload Safety Program**
- **CHAPTER 1 Program Overview**
 - **Payload Safety Policy (consistent with general policy in NPR 8715.3)**
 - **Roles and Responsibilities (moved from NPR 8715.3 and updated)**
 - **Variance Process (consistent with NPR 8715.3)**
- **CHAPTER 2 Safety Review and Approval Process**
 - **Payload Safety Working Group**
 - **Roles and Responsibilities**
 - **Flow of Activities and Deliverables**
 - **Content of Deliverables**
- **CHAPTER 3 Payload Design and Ground Operations Safety Requirements**
 - **General Payload Flight Hardware and GSE Safety Design**
 - **Safety Critical Software**
 - **Ground Operations**
 - **Payload Flight Hardware and GSE**



ELV Payload Safety Program Implementation

- **Policy**
- **Processes**
- **Requirements**
- **Training: Develop and administer**
 - **Manager's Course (~1 day)**
 - **PSWG Participant Course (~3 days)**
 - **Systems Engineer's Overview (2-hours)**
- **Agency Team transforms from development to implementation**
 - **Consultation**
 - **Interpretation**
 - **Issue resolution**
 - **Decision Assistance (Waivers)**
 - **Assessments to ensure processes are followed**



ELV Payload Safety Program Evaluation and Review for Improvements

- **Agency Team**
 - **Assessments**
 - **Audits**
 - **Metrics and Trends**
- **NASA HQ OSMA Audits**
- **PSWG and Payload Project (customer) Feedback**
- **Evaluate, revise and improve processes and requirements**
 - **NASA Interim Directives**
 - **NPR Updates and Revision**



ELV Payload Safety Program

Questions?